SET-1

Mock Exam:2025-26

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O.P. Code E/1/22

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Candidate must write the Q.P.

Class – 12th

Xkf.kr &lSökfUrd

MATHEMATICS – Theory

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Time allowed: 3 hours	Maximum marks: 80

UkksV@NOTE:

(i)Ñi;k tkWap dj ysa fd bl iz"u & i= esa eqfnzr i`"B 14 gSaA

Please check that this question paper contains 14 printed pages.

(ii)Ñi;k tkWap dj ysa fd bl iz"u &i= esa 38 iz"u gSaA

Please check that this question paper contains 38 questions.

(iii)iz"u &i= esa nkfgus gkFk dh vksj fn, x, iz'u & i= dksM dks ijh{kkFkhZ mRrj iqfLrdk ds eq+[k &i`"B ij fy[ksaA

Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) Ñi;k iz"u dk mRrj fy[kuk 'kq# djus ls igys] mRrj iqfLrdk esa iz'u dk Øekad vo'; fy[ksaA

Please write down the serial number of the question in the answer-book before attempting it.

(v) bl iz"u &i= dks i<us ds fy, 15 feuV dk le; fn;k x;k gSA iz"u &i= dk fooj.k iwokZâ es 10-15 cts fd;k tk,xkA 10-15 cts ls 10-30 cts rd Nk= dsoy iz'u & i= dks i<saxs vkSj bl vof/k ds nkSjku os mRRkj iqfLrdk ij dksbZ mRRkj ugha fy[ksaxsA

15 minutes time has been allotted to read this question paper. The question paper will be distributed at 9.15 a. m. From 9.15 a.m. to 9.30 a.m., the students will read the question paper only and will not write any answer on the answer – book during this period.

General Instructions:

Read the following instructions very carefully and strictly follow them:

1. This question paper contains **38** questions. **All** questions are **compulsory.**
2. This question paper is divided into **five** Sections - **A, B, C, D** and **E.**
3. In **Section A**, Questions no. **1** to **18** are multiple choice questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.
4. In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.
5. In **Section C,** Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.
6. In **Section D,** Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.
7. In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and 2 questions in Section E.
9. Use of calculator is not allowed.

SECTION-A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. A = $\begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A^3 is

(a) $3\begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ (b) $\begin{bmatrix} 125 & 0 & 0 \\ 0 & 125 & 0 \\ 0 & 0 & 125 \end{bmatrix}$

(c) $\begin{bmatrix} 15 & 0 & 0 \\ 0 & 15 & 0 \\ 0 & 0 & 15 \end{bmatrix}$ (d) $\begin{bmatrix} 5^3 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$

2. If P(A ∪ B) = 0.9 and P(A ∩ B) = 0.4, then P($\bar{A}$)+P($\bar{B}$) is

(a) 0.3 (b) 1 (c) 1.3 (d) 0.7

3. If A = $\begin{bmatrix} 1 & 2 & 3 \\ -4 & 3 & 7 \end{bmatrix}$ and B = $\begin{bmatrix} 4 & 3 \\ -1 & 2 \\ 0 & 5 \end{bmatrix}$, then the correct statement is

(a) Only AB is defined

(b) Only BA is defined

(c) AB and BA, both are defined

(d) AB and BA, both are not defined

4. If $\begin{vmatrix} 2x & 5 \\ 12 & x \end{vmatrix} = \begin{vmatrix} 6 & -5 \\ 4 & 3 \end{vmatrix}$, then the value of x is

(a) 3 (b) 7 (c) ± 7 (d) ± 3

5. If f(x) = $\begin{cases} \frac{sin^2 ax}{x^2}, x \neq 0 \\ 1, \quad x = 0 \end{cases}$ is continuous at x = 0, then the value of a is

(a) 1 (b) - 1 (c) ± 1 (d) 0

6. If A= $[a_{ij}]$ is a 3 × 3 diagonal matrix such that $a_{11} = 1, a_{22} = 5 \; and \; a_{33} = -2$, then $|A|$ is

(a) 0 (b) - 10 (c) 10 (d) 1

7. The principal value of $cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ is

(a) - $\frac{\pi}{3}$ (b) - $\frac{2\pi}{3}$ (c) $\frac{\pi}{3}$ (d) $\frac{2\pi}{3}$

8. If $\begin{bmatrix} 4+x & x-1 \\ -2 & 3 \end{bmatrix}$ is a singular matrix, then the value of x is

(a) 0 (b) 1 (c) – 2 (d) - 4

9. If f(x) = $\{[x], x \in \mathbb{R}\}$ is the greatest integer function, then the correct statement is

(a) f is continuous but not differentiable at x = 2

(b) f is neither continuous nor differentiable at x = 2

(c) f is continuous as well as differentiable at x = 2

(d) f is not continuous but differentiable at x = 2

10. The slope of the curve y = - $x^3 + 3x^2 + 8x - 20$ is maximum at

(a) (1, - 10) (b) (1, 10)

(c) (10, 1) (d) (- 10, 1)

11. $\int \sqrt{1+\sin x}$ dx is equal to

(a) $2\left(-\sin\frac{x}{2}+\cos\frac{x}{2}\right)+\ C$

(b) $2\left(\sin\frac{x}{2}-\cos\frac{x}{2}\right)+\ C$

(c) - $2\left(\sin\frac{x}{2}+\cos\frac{x}{2}\right)+\ C$

(d) $2\left(\sin\frac{x}{2}+\cos\frac{x}{2}\right)+\ C$

12. $\int_0^{\frac{\pi}{2}} \cos x . e^{\sin x}$ dx is equal to

(a) 0 (b) 1 – e (c) e – 1 (d) e

13. The area of the region enclosed between the curve y = x $|x|,\ x-axis,\ x=-2$ and x = 2 is

(a) $\frac{8}{3}$ (b) $\frac{16}{3}$ (c) 0 (d) 8

14. The integrating factor of the differential equation

$\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}}-\frac{y}{\sqrt{x}}\right)\frac{dx}{dy}=1\ is$

(a) $e^{-\frac{1}{\sqrt{x}}}$ (b) $e^{\frac{2}{\sqrt{x}}}$ (c) $e^{2\sqrt{x}}$ (d) $e^{-2\sqrt{x}}$

15. The sum of the order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^3=\frac{d^2y}{dx^2}\ is$

(a) 2 (b) $\frac{5}{2}$ (c) 3 (d) 4

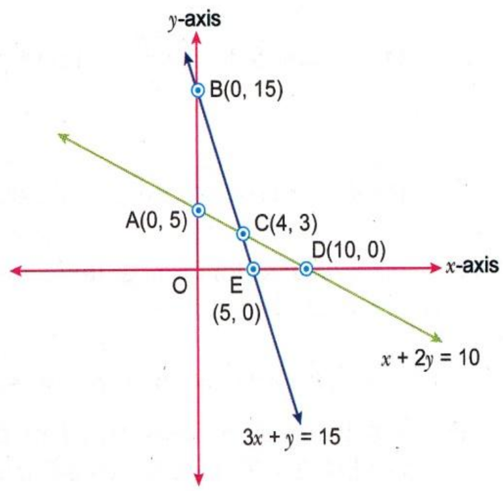
16. For a linear Programming Problem (LPP), the given objective function Z = 3x + 2y is subject to constraints

$x + 2y \leq 10$,

$3x + y \leq 15$;

$x, y \geq 0$,

The correct feasible region is



(a) ABC

(b) AOEC

(c) CED

(d) Open unbounded region BCD

17. Let $\vec{a}$ be a position vector whose tip is the point (2, - 3). If $\overrightarrow{AB} = \vec{a}$, where coordinates of A are (- 4, 5), then the coordinates of B are

(a) (- 2, - 2) (b) (2, - 2)

(c) (- 2, 2) (d) (2, 2)

18. The respective values of and $|\vec{a}|$ *and* $|\vec{b}|$, if given $(\vec{a} - \vec{b}).(\vec{a} + \vec{b}) = 512$ and $|\vec{a}| = 3|\vec{b}|$ *are*

(a) 48 and 16 (b) 3 and 1

(c) 24 and 8 (d) 6 and 2

Direction: Question numbers 19 and 20 are Assertion (A) and Reason (R) based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and other labelled Reason (R). Select the correct answer from the options given below.

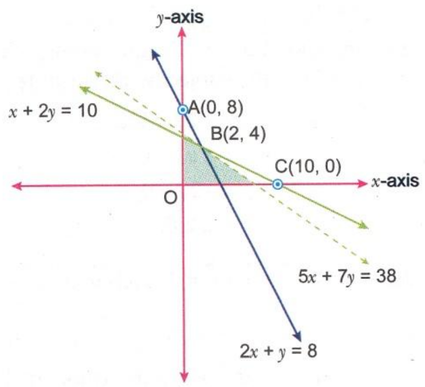
(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

19. **Assertion (A):** The shaded portion of the graph represents the feasible region for the given Linear Programming Problem (L.PP).



Min Z = 50x + 7y

subject to constraints

$2x + y \geq 8,\ x + 2y \geq 10$

$x, y \geq 0.$

Z = 50 x + 70y

has a minimum value = 380 at B(2, 4).

Reason (R) : The region representing 50x + 70y < 380 does not have any point common with the feasible region.

20. **Assertion (A):** Let A = $\{x \in \mathbb{R} : -1 \leq x \leq 1\}$.

If f : A → A be defined as f(x) = x^2, then f is not an onto function.

Reason (R) : If y = - 1 ∈ A, then x = $\pm\sqrt{-1} \in A$.

SECTION-B

This section comprises 5 Very Short Answer (VSA) type questions of 2 marks each.

21. Find the domain of the function f(x) = $cos^{-1}(x^2 - 4)$.

22. Surface area of a balloon (spherical), when air is blown into it, increases at a rate of 5 $mm^2/$s. When the radius of the balloon is 8 mm, find the rate at which the volume of the balloon is increasing.

23. (a) Differentiate $\frac{\sin x}{\sqrt{\cos x}}$ with respect to x.

OR

(b) If y = 5 cos x - 3 sin x, prove that $\frac{d^2y}{dx^2} + y = 0$.

24. (a) Find a vector of magnitude 5 which is perpendicular to both the vectors $3\hat{\imath} - 2\hat{\jmath} + \hat{k}$ and $4\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$.

OR

(b) Let $\vec{a}, \vec{b}$, and $\vec{c}$ be three vectors such that $\vec{a}.\vec{b} = \vec{a}.\vec{c}$ and $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}, \vec{a} \neq \vec{0}$. Show that $\vec{b} = \vec{c}$.

25. A man needs to hang two lanterns on a straight wire whose end points have coordinates A(4, 1, - 2) and B(6, 2, - 3). Find the coordinates of the points where he hangs the lanterns such that these points trisect the wire AB.

SECTION-C

This section comprises 6 Short Answer (SA) type questions of 3 marks each.

26. Find the value of 'a' for which f(x) = $\sqrt{3}$ sin x - cos x - 2ax + 6 is decreasing in ℝ.

27. (a) Find $\int \frac{2x}{(x^2+3)(x^2-5)}$ dx.

OR

(b) Evaluate $\int_1^4 (|x-2| + |x-4|)$ dx.

28. Find the particular solution of the differential equation $\left[x\, sin^2\left(\frac{y}{x}\right) - y\right] dx + x\, dy = 0$ given that y = $\frac{\pi}{4}$, when x = 1.

29. In the Linear Programming Problem (LPP), find the point/points giving maximum value for Z = 5x + 10y subject to constraints

x + 2y ≤ 120,

x + y ≥ 60,

x - 2y ≥ 0;

x, y ≥ 0.

30. (a) If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ such that $|\vec{a}| = 3, |\vec{b}| = 5, |\vec{c}| = 7$, then find the angle between $\vec{a}$ and $\vec{b}$.

OR

(b) If $\vec{a}$ and $\vec{b}$ are unit vectors inclined with each other at an angle θ, then prove $\frac{1}{2}|\vec{a} - \vec{b}| = \sin\frac{\theta}{2}$.

31. (a) The probability that a student buys a colouring book is 0.7 and that she buys a box of colours is 0.2 The probability that she buys a colouring book, given that she buys a box of colours, is 0.3. Find the probability that the student

(i) Buys both the colouring book and the box of colours.

(ii) Buys a box of colours given that she buys the colouring book.

OR

(b) A person has a fruit box that contains 6 apples and 4 oranges. He picks out a fruit three times, one after the other, after replacing the previous one in the box. Find The probability distribution of the number of oranges he draws.

SECTION-D

This section comprises 4 Long Answer (LA) type questions of 5 marks each.

32. Sketch a graph of y = x^2. Using integration, find the area of the region bounded by y = 9, x = 0 and y = x^2.

33. A furniture workshop produces three types of furniture - chairs, tables and beds each day. On a particular day the total number of furniture pieces produced is 45. It was also found that production of beds exceeds that of chairs by 8, while the total production of beds and chairs together is twice the production of tables. Determine the units produced of each type of furniture, using matrix method.

34. (a) If x = a $cos^3\theta$ and y = a $sin^3\theta$, then find the value of $\frac{d^2y}{dx^2}$ $at\ \theta = \frac{\pi}{6}$.

OR

(b) If y = $e^{msin^{-1}x}$ $if\ -1 \leq x \leq 1, then\ show\ that$

$$(1 - x^2)\frac{d^2y}{dx^2} - \frac{xdy}{dx} - m^2y = 0.$$

35. (a) Find the foot of the perpendicular drawn from the point (1, 1, 4) on the line $\frac{x+2}{5} = \frac{y+1}{2} = \frac{-z+4}{-3}$.

OR

(b) Find the point on the line $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-4}{3}$ at a distance of $2\sqrt{2}$ units from the point (- 1, - 1, 2).

SECTION-E

This section comprises 3 case study based questions of 4 marks each.

Case Study-1

35. A carpenter needs to make a wooden cuboidal box, closed from all sides, which has a square base and fixed volume. Since he is short of the paint required to paint the box on completion, he wants the surface area to be minimum.

On the basis of the above information, answer the following questions:

(i) Taking length = breadth = x m and height = y m , express the surface area (S) of the box in terms of x and its volume (V), which is constant. (1)

(ii) Find $\frac{dS}{dx}$. (1)

(iii) (a) Find a relation between x and y such that the surface area (S) is minimum. (2)

Case Study - 2

36. Let A be the set of 30 students of class XII in a school. Let f : A -→ N, N is a set of natural numbers such that function f(x) = Roll number of student x.

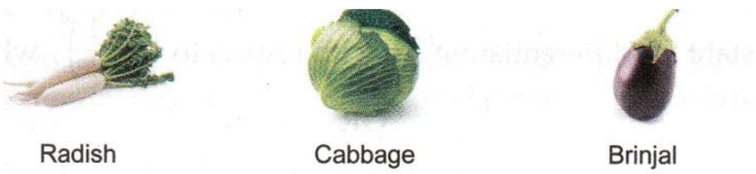
On the basis of the above information, answer the following questions:

(i) Is f a bijective function? Give reasons to support your answer . (2)

(ii) Let R be a relation defined by the teacher to plan the seating arrangement of students in pairs, where R= {(x, y) :x, y are roll numbers of students such that y=3x}. List the elements of R. Is the relation R reflexive, symmetric and transitive? Justify your answer. (2)

Case Study-3

37. A gardener wanted to plant vegetables in his garden. Hence he bought 10 seeds of brinjal plant, 12 seeds of cabbage plant and 8 seeds of radish plant. The shopkeeper assured him of germination probabilities of brinjal, cabbage and radish to be 25%, 35% and 40% respectively. But before he could plant the seeds, they got mixed up in the bag and he had to sow them randomly.



Based upon the above information, answer the following questions:

(i) Calculate the probability of a randomly chosen seed to germinate. (2)

(ii) What is the probability that it is a cabbage seed, given that the chosen seed germinates? (2)